GROWING IRRIGATED CROPS on the canadian prairies

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CONTENTS

GROWING IRRIGATED CROPS on the canadian prairies

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INTRODUCTION

Irrigation in Western Canada is practiced in areas where rainfall is deficient and summer temperatures and evaporation are high. In Alberta, organized irrigation began in 1901. By 1968 there were 900,000 irrigable acres in southern Alberta, and another third of a million acres were potentially irrigable. Saskatchewan has 186,000 irrigable acres. In Manitoba, irrigation is confined to small acreages of private irrigation schemes, but the development of the Pembina project will provide 20,000 irrigable acres. This publication describes common agricultural practices and gives advice to farmers growing irrigated crops on the Canadian Prairies.

MANAGEMENT OF IRRIGATED LAND

Some rules of good management are:

- Use recommended varieties
- Seed to the most suitable depth
- Apply the right kind and amount of fertilizer
- Apply the right amount of water at the proper time

Skill and good judgment are needed for:

- Machine operation
- Irrigation
- Decision-making based on the best chances of success

To improve your management:

- Apply the latest scientific knowledge
- Develop your skills
- Gain experience in making the best possible decisions

IRRIGATION

Gravity irrigation and sprinkling are the two chief methods of applying water. Both methods have advantages and disadvantages. These methods are described in *Irrigation Water, Its Use and Application*, Canada Department of Agriculture Publication 1199, 1966.

Generally, it is time to irrigate crops when not more than half of the available water has been depleted. Plants that lack water turn dark green, and their leaves are often curled or wilted. Apply water before these symptoms become too apparent.

SOIL FERTILITY

With irrigation, moisture should not be limiting, and the main factor that limits crop production is soil fertility. To increase the fertility of your soil use:

- Barnyard manure
- Legumes or leguminous green manure
- Chemical fertilizers

BARNYARD MANURE

Barnyard manure increases the soil fertility and also improves its physical condition. It lightens a heavy soil and makes a light soil less susceptible to erosion by binding it together. One ton of barnyard manure contains about 10 pounds of N, 5 pounds of P_2O_5, and 10 pounds of K_2O. It also contains many of the trace elements that plants need in minute quantities, and it favors growth of microorganisms.

Cereal straw used as bedding for animals absorbs urine, which contains nitrogen and adds organic material to the manure. Each day, cattle need about 8 pounds of straw per animal for bedding. An acre of irrigated wheat produces about 1 1/4 tons of straw, oats a little more, and barley a little less. One hundred steers on full ration in a well-bedded feedlot provide about 60 tons of manure per month. Feedlot lambs produce less manure per pound of body weight than cattle, but the manure is drier and has more fertilizer value per ton.

The rate of application of manure to fields varies from 8 to 20 tons per acre. If you have only 100 tons of manure, it is better to apply 10 tons per acre to 10 acres of land than 20 tons per acre to 5 acres.

The best time to apply manure is late summer or early fall, to land from which a pea crop or an early cereal has been harvested. The manure should be plowed under without delay and the field should be irrigated. Well-rotted manure can be applied to the land in early spring if it is plowed in immediately. Pastures and hayfields should be manured in fall if possible.

LEGUME CROPS

Since legumes are able to take nitrogen from the air and add it to the soil, crops that have well-nodulated roots, such as alfalfa and sweet clover, can be used to increase the nitrogen content of a soil. A well-nodulated legume crop can fix 50 to 100 pounds of nitrogen per acre per year. If the entire crop is plowed under, the soil will gain that amount of nitrogen. When the aboveground portion of the plant is removed for produce, less nitrogen is added to the soil. Nitrogen is the only element added to the soil by legume crops.

GREEN-MANURE CROPS

A green-manure crop is one that is grown for plowing under to improve the soil. All green-manure crops add organic matter to the soil, but nodulated legume crops add nitrogen also. Sweet clover is commonly used as a green-manure crop.

Organic matter improves the structure of a soil by binding the small particles together. In this way it helps aeration and often increases the water-holding capacity of the soil. But generally the beneficial effects of improved soil structure on crop yields are hard to measure.

The disadvantage of a green-manure crop is the loss of revenue from the land while the crop is growing. To offset this loss, seed sweet clover with a grain crop in the spring, plow it under in June of the following year, and then seed a short-season crop. For pasture a good crop to follow the plowing is a sorghum–Sudangrass hybrid. Another possibility was demonstrated at the Research Station, Lethbridge, where canning corn produced a profitable crop after sweet clover was plowed under in May. Sugar beets grown on the same land the next year produced nearly as well as beets on summerfallow.

CHEMICAL FERTILIZERS

Plants require 16 nutrients for satisfactory growth. They must obtain 13 of them from the soil. Nitrogen and phosphorus are usually lacking in most prairie soils. In some areas potassium is in short supply. Sulfur is deficient in some Gray Wooded soils, and additional manganese is needed for oats in certain foothills areas. It is possible that supplies of available forms of other nutrients may be low in some soils.

Chemical fertilizers provide the necessary plant food. They are available in granular, liquid, and gaseous form. Every bag or container of chemical fertilizer has a guaranteed analysis marked on it. Obtain a soil test to help you determine the kind and amount of fertilizer to use. Calculate the cost per pound of nutrient, and buy it in the cheapest form.

WEED CONTROL

Weeds are often a major problem on irrigated land, especially along or near ditch banks. The irrigation water carries weed seeds and spreads them throughout fields. Because the soil is moist, the seeds germinate quickly and the weeds grow profusely. As in other types of farming, weeds on irrigated farms are controlled by cultural and chemical methods.

CULTURAL CONTROL

Since annual weeds grow from seeds each year, the obvious control is to prevent seed formation. In row crops, control weeds by careful cultivation, and in hayfields by mowing the crop before the seeds form.

Persistent perennial weeds are harder to eradicate. As long as food is available to them, the rootstalks of these perennials will continue to send up new shoots. To control perennial weeds you must cultivate often enough to deplete the food reserves in the roots.

CHEMICAL CONTROL

Many selective herbicides have been developed in recent years. When used properly they are very effective in eradicating or controlling weeds. Because new weed chemicals are licensed every year, consult your latest provincial weed control publication and follow the instructions carefully.

CROP ROTATION

Crop rotation is the growing of various crops in a predetermined order on the same piece of land. At least 30 crops can be grown economically on irrigated land in Western Canada. The choice of crops to grow is yours, but remember that because some are grown under contract their acreage is limited. Rotations may limit flexibility, but this disadvantage can be overcome.

Crop rotations should:

- Provide maximum acreages of the most profitable crops
- Allow for distribution of labor and equipment
- Distribute risks
- Help to control weeds, pests, and soil erosion

To plan your crop rotation:

- Decide on the main crops to grow and the acreages of each
- Divide your farm into the number of fields that you need
- Make allowances for possible future changes in cropping

Let us assume that you are farming a half section of land on which 280 acres are irrigable. You want to grow alfalfa on at least 100 acres and you have a 40-acre beet contract and a 20-acre pea contract. You also want to grow some grain. Your rotation might take this form:

Year of rotation	Crop	Acreage
1	Grain and alfalfa seeding	40
2	Alfalfa 1	40
3	Alfalfa 2	40
4	Alfalfa 3	40
5	Grain	40
6	Peas (20 acres), other crop (20 acres)	40
7	Sugar beets	40

Divide your land into seven 40-acre fields. Because of irrigation ditches, sloughs, or other obstructions, your fields may not all be the same shape. This rotation provides ample acreage of each of the crops that you want to grow and allows 60 acres for flexibility (40 acres in the 5th year and 20 acres in the 6th year of rotation). You will be able to increase the acreages of your two contract crops, gain experience with new crops, or grow any crop that has a favorable market price.

Summerfallowing has no place in irrigation farming except when weeds are a serious problem or when the land needs leveling. Some farmers fallow their land because in the following year the land may produce 2 or 3 tons more sugar beets per acre. This is a small return for the loss of one year.

No crop rotation is ideal for everyone. A rotation that includes at least 3 years of alfalfa or alfalfa—grass tends to maintain the organic matter content of the soil.

CROP SEQUENCE

The order in which crops are grown in rotation on the same land is called crop sequence. If soil fertility is low, crops that follow legumes yield more than those that do not. When soil fertility is high, the advantage of cropping in sequence diminishes.

After a legume crop or an application of manure, give the best place in the sequence to the most remunerative crop. For example, sugar beets do well after peas. Peas are a legume crop and are harvested early. This provides a good opportunity in the rotation to spread barnyard manure on the pea stubble, plow it under, and then irrigate. The legume residue and manure will break down during the remainder of the season and will thus ensure a fertile soil well supplied with soil moisture for the following crop.

SUGAR BEETS

The acreage of sugar beets grown on irrigated land in southern Alberta has increased from 5,000 in 1925 to 43,000 in 1968. The average yield is about 13 tons per acre but 20 tons or more are often obtained. The sugar content ranges from 15 to 17 percent. Sugar beets are also grown in southern Manitoba on dry land.

CHOICE OF LAND

Sugar beets grow well on many types of soil, from heavy clay to loamy sand, but loam is best. They can tolerate moderate amounts of salt, though land with a water table near the surface is unsuitable. In Alberta, the best crops of sugar beets are grown on fertile, weed-free, well-drained land that has a gentle slope to allow adequate, uniform irrigation.

SEEDBED PREPARATION

The ideal seedbed for sugar beets is fine, moist, and firm, contains few lumps, has ample moisture within an inch of the surface, and is of a firmness that allows the heel and toe marks of a footprint to show but not the instep.

Plow and level the land in the fall, if at all possible. In the spring, cultivate lightly to destroy weed seedlings, harrow several times to break down the lumps, and pack the soil firmly.

Avoid planing in the spring because the low places fill with loose soil and the high spots have too little and dry out. The result is patchy germination. Avoid plowing in the spring, especially after row crops. Instead, cultivate the land fairly deeply to loosen the soil, then harrow, and pack well to prevent loss of moisture. When it is necessary to plow in the spring, for example to turn stubble under, pack the soil well and pulverize the lumps, except on light soils that may drift.

FERTILIZING

To produce high yields, sugar beets need plenty of nitrogen and phosphorus. Most fields need 40 to 80 pounds of P_2O_5 per acre. Suitable formulations are 11-48-0 or 11-55-0. Apply these fertilizers in bands near the seed at planting time. Some fields require nitrogen; do not apply more than 80 pounds per acre. Obtain a soil test for specific recommendations for your fields.

To germinate, the sugar beet seeds must take up about one-third of their weight in water. Insufficient soil moisture will delay or even prevent germination. Highly soluble fertilizers, particularly the nitrogenous ones, readily absorb moisture from the soil. For this reason they should not be placed near the seed. Instead, they

should be broadcast and worked into the soil before seeding, or applied as a side-dressing later.

SEEDING

Sugar beet seed is supplied to growers by the contracting company. Monogerm seed grown on the west coast of British Columbia is used exclusively in Alberta. The seed drills plant four or six rows, 22 inches apart, at one time. Sow 3.2 to 3.4 pounds per acre (about six seeds per foot). Drive no faster than 3 miles per hour. Plant 1 to 1 1/2 inches deep, ensuring that the seed is firmly covered. Sow as early as possible in the spring. The maximum growing season for sugar beets in Alberta is 5 months. The seedlings are susceptible to frost for a few days after they emerge, but are less susceptible once they develop true leaves.

THINNING AND WEEDING

For highest yield there should be about 24,000 sugar beet plants per acre. This means that with rows 22 inches apart you should space the plants about 1 foot apart within the row. Monogerm seed has reduced the time and cost of thinning and hoeing sugar beets. If you thin by hand, begin as soon as the seedlings have four true leaves. If you use rotary thinners, now in general use, estimate the stand of the beet seedlings, then fit rotary heads with knives of the correct size. Follow up with hand hoeing to establish a final stand of 100 plants per 100 feet of row.

IRRIGATION

Sugar beets are a long-season crop that needs a great deal of water. At the Research Station, Lethbridge, the highest yields of beets have been obtained on land that was irrigated in the previous fall and three or four times during the season.

Begin irrigating soon after thinning, and in dry years irrigate every 3 weeks. Time the last irrigation to leave the soil moist for harvesting. This makes digging easier, and increases yields and storing quality of the beets.

HARVESTING

Harvesting sugar beets is now completely mechanical. Speedy, efficient machines dig, top, and load sugar beets, one or two rows at a time. Some machines perform the topping operation separately.

The longer you can delay harvest safely, the higher the yield and sugar content.

POTATOES

Potatoes are grown extensively under irrigation and are a good cash crop. In past years the acreages have fluctuated, depending on the prospective market. Potato processing plants and improved handling and packaging facilities have resulted in an increased and more stabilized acreage. Some potatoes are now grown under contract.

As an irrigated crop, potatoes have several advantages:

- They need to be well cultivated, which gives good weed control
- They fit well into rotations, particularly before sugar beets or cereal crops
- They are planted after the rush of seeding other irrigated crops is practically over

CHOICE OF LAND

Potatoes grow best on loam or sandy loam, but heavier soils are satisfactory if they are well drained and carefully prepared. The ideal land has a gentle slope to allow for thorough, uniform irrigation. In a rotation, potatoes do well after a sod crop or a green-manure crop. Plant on land known to be free from wireworms. To minimize scab, do not apply manure in the year that potatoes are planted.

SEEDBED PREPARATION

The ideal seedbed for potatoes is deep, mellow, moist, and free from weeds. Plow the land during the summer or fall before planting. If potatoes are to follow alfalfa, in August plow under the second crop of alfalfa, cultivate well, and irrigate. Before planting potatoes in the spring, cultivate the land 5 to 6 inches deep to destroy weeds and to mellow the soil; then pack it well to preserve moisture.

FERTILIZING

Potato fields usually need added nitrogen and phosphorus. On sandy soils the greatest need is usually for nitrogen, but on heavy-textured soils it is for phosphorus. In some areas potassium may also be required. To obtain the best information, have the soil tested. At planting time place the fertilizer in bands on both sides of the row, slightly to the side and below the sets. Or, you may apply part of the fertilizer at planting time, and side-dress with the remainder when the plants are between 6 and 10 inches high.

PLANTING

Select, treat, cut, and handle your seed potatoes carefully. Protect the sets from

drying and injury. It is best to cut, treat, and plant the potatoes on the same day, but, if this is not possible, allow the surfaces of cut potatoes to heal to keep them from rotting.

Plant potatoes in rows 36 inches apart, using one- or two-row mechanical planters operated at moderate speed. Place the seed pieces about 12 inches apart and 3 to 4 inches deep in warm, moist soil. If the seedbed is very fertile, place them closer; if it is poor, place them farther apart.

The number of seed pieces needed depends on the size and spacing of sets and the number of rows per acre. For 1 1/2-ounce pieces, which are usually the best size to use, 12 inches apart in rows 36 inches apart, you need about 23 bushels of seed per acre; for 2-ounce pieces, about 30 bushels.

CULTIVATION

Careful, timely cultivation eliminates the need for hand hoeing. Begin cultivating as soon as weed seedlings appear. If the field has been properly prepared, you may safely harrow it several times before the potato plants emerge. A finger weeder is also effective for weed control, both before and after the plants are up.

As soon as the rows of plants are visible, start using a cultivator to throw the soil toward the rows and smother small weeds. As the plants grow continue such cultivation, building up hills and leaving furrows for irrigation. In medium to heavy soil make deep, narrow furrows so that soil near the tubers will not remain saturated after irrigation; in sandy soils make the furrows shallow and wide to bring water closer to the plants.

IRRIGATION

For highest yields and best quality, keep potatoes growing vigorously from the time they emerge until shortly before harvest. Maintain the soil moisture in the upper half of the available range. When the soil is too dry during the first few weeks, the potato vines and leaves stay small; when it is too dry during tuber formation, fewer tubers are formed, and these, if irrigated later on, may develop into large, rough potatoes. Over half of the water a potato gets comes from the top 12 inches of soil, and over three-quarters of the water from the top 24 inches. Therefore, to keep the surface layers of the soil moist, you must irrigate lightly and often. Time the last irrigation so that the soil will be moist for harvesting. Adequate irrigation by either the surface or the sprinkler method gives the same yields.

HARVESTING

Harvest potatoes early enough to avoid frost damage to tubers. When the vines have been destroyed mechanically or with chemicals, the potatoes mature faster and the risk of damage to the potatoes during harvest is reduced.

Run potato diggers deep enough to pick up sufficient soil on the digger chain to cushion the potatoes and to keep them from being bruised. Handle potatoes carefully throughout the harvesting operation. Use padded truck boxes and conveyor belts.

SWEET CORN

Sweet corn is grown for canning, freezing, and the fresh market. Improved methods of cooling and handling have resulted in an increased volume of sweet corn grown for the fresh market. The average yield is 4 1/2 tons per acre, but yields of up to 8 tons are common. Early to midseason varieties (105- to 125-day growing season) are best suited for the climate of the Prairie Provinces.

CHOICE OF LAND

Corn grows well on almost any type of soil, but it matures earliest on well-prepared sandy loams. The yield depends on the fertility of the soil and the amount of irrigation. Corn grows well after any crop; however, it is probably better suited than other crops to follow a cereal grain.

SEEDBED PREPARATION AND SEEDING

Since corn seeds are large, the crop does not need as fine a seedbed as many other crops. Till the land to destroy weed seedlings and to ensure that the seedbed is firm and moist. In early May when the soil has warmed up, sow the seeds 1 to 3 inches deep into moist soil. Rows can be 22 inches apart, but, if you harvest by machine, space the rows 40 inches apart. Plan for a final stand of about 18,000 plants per acre.

CULTIVATION

Because corn is a row crop, it is suitable for getting rid of weeds. Careful cultivation and, sometimes, hoeing are needed. Harrow to destroy the small weeds that come up ahead of the corn, and, when the corn is 3 or 4 inches high, harrow again if necessary. The second harrowing should be along the rows so that the corn stalks are not pulled out. Cultivate to control weeds between the rows. Use selective weed sprays or hoe the weeds that are within the rows.

FERTILIZING

To produce maximum yields most cornfields need phosphorus and nitrogen

fertilizers. For best results apply the phosphorus fertilizer in bands to the side of and below the seed. Nitrogen increases the number of ears per plant. Ideally, by harvesting time each plant should have two fully matured ears. Nitrogen fertilizer can be broadcast and worked into the soil before planting, banded to the side of and below the seed at planting time, or it can be side-dressed when the plants are 6 to 12 inches high. Obtain a soil test recommendation for each field.

IRRIGATION

For surface irrigation be sure that the land is level so that the water can be applied uniformly. Corn requires about 15 inches of water. About half of this amount may be needed during the 6 weeks from tasseling to silking. On a hot, windy day an acre of corn can use half an inch of water. Start irrigating when the water in the top 12 to 15 inches of soil is reduced to 50 percent of the available range. Irrigate continuously in this manner until the end of August.

STOVER FOR SILAGE

Corn plants remain green and succulent for a while after the ears are picked. The stover contains useful amounts of sugar and protein, and silage made from it has about one-third of the food value of silage made from whole plants of field corn, including the ears.

To prepare the stover quickly and cheaply, use a traveling ensilage cutter, which will leave the land clean and easy to prepare as a seedbed the following spring.

If you do not ensile the stover, plow it under in the fall, and pack the soil well. Irrigate, if necessary, to provide enough moisture for decomposition.

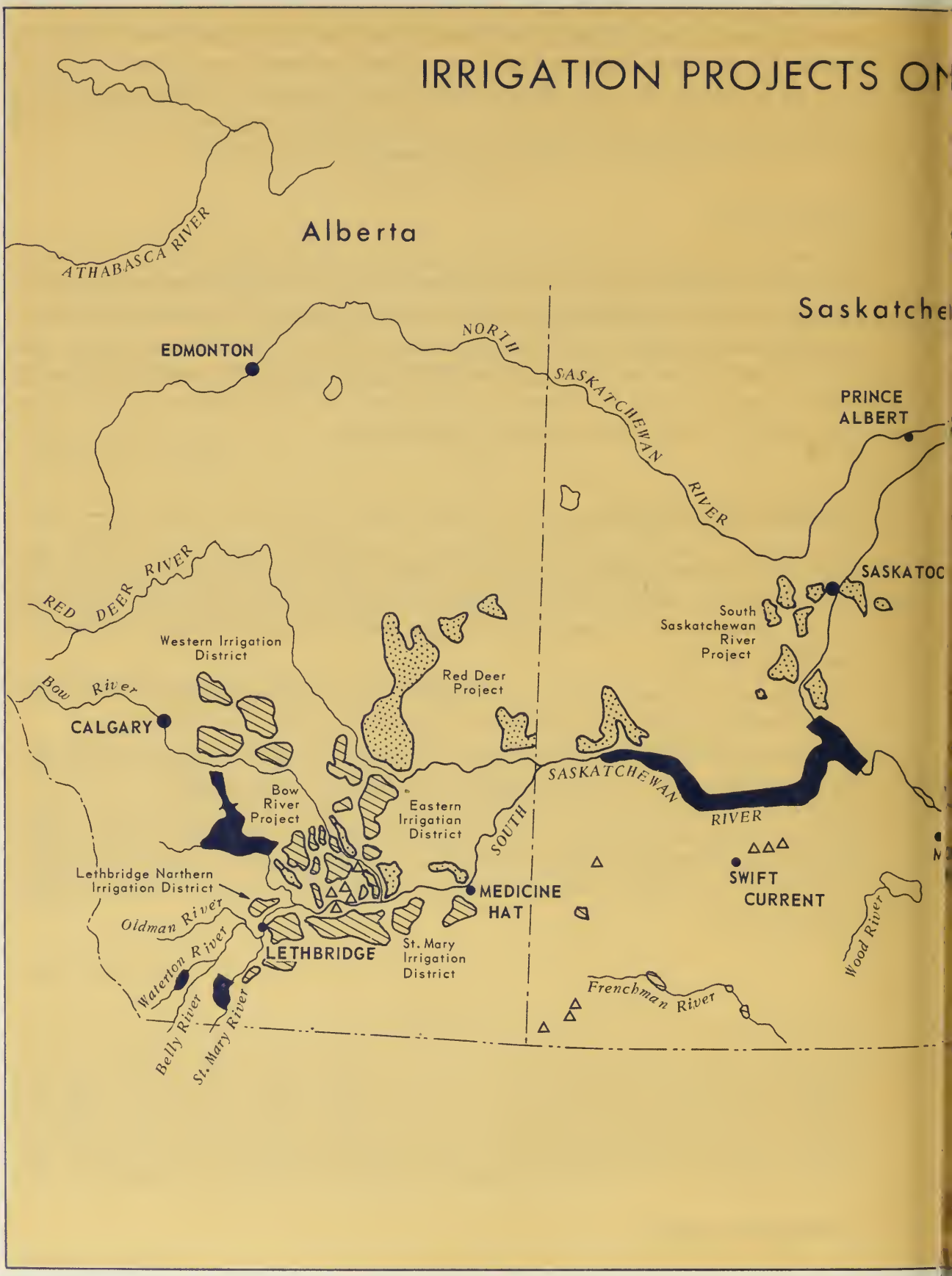
Some growers pasture their corn stover. Pasturing gives much less feed than silage because the leaves and stalks soon become dry and unpalatable. Stalks left standing over winter are hard to work into the soil in the spring and they keep the seedbed loose and open.

PEAS

Peas for canning and freezing and for seed are usually grown under contract. Growers should aim for 2 tons per acre or better of green shelled peas. Yields of 1 to 1 1/2 tons of dry pea seed are possible. Green peas also yield about 2 tons of hay or 5 to 6 tons of ensilage per acre, a by-product that is a valuable livestock feed.

CHOICE OF LAND

Peas fit very well into an irrigated-crop rotation, and the crop that follows them usually does well. A good crop of peas may be grown on land that previously


IRRIGATION PROJECTS ON
Alberta
Saskatche
ATHABASCA RIVER
EDMONTON
NORTH SASKATCHEWAN RIVER
PRINCE ALBERT
SASKATOC
RED DEER RIVER
Western Irrigation District
Red Deer Project
South Saskatchewan River Project
Bow River
CALGARY
Bow River Project
Eastern Irrigation District
SASKATCHEWAN RIVER
SOUTH
Lethbridge Northern Irrigation District
Oldman River
Waterton River
LETHBRIDGE
St. Mary Irrigation District
MEDICINE HAT
SWIFT CURRENT
Wood River
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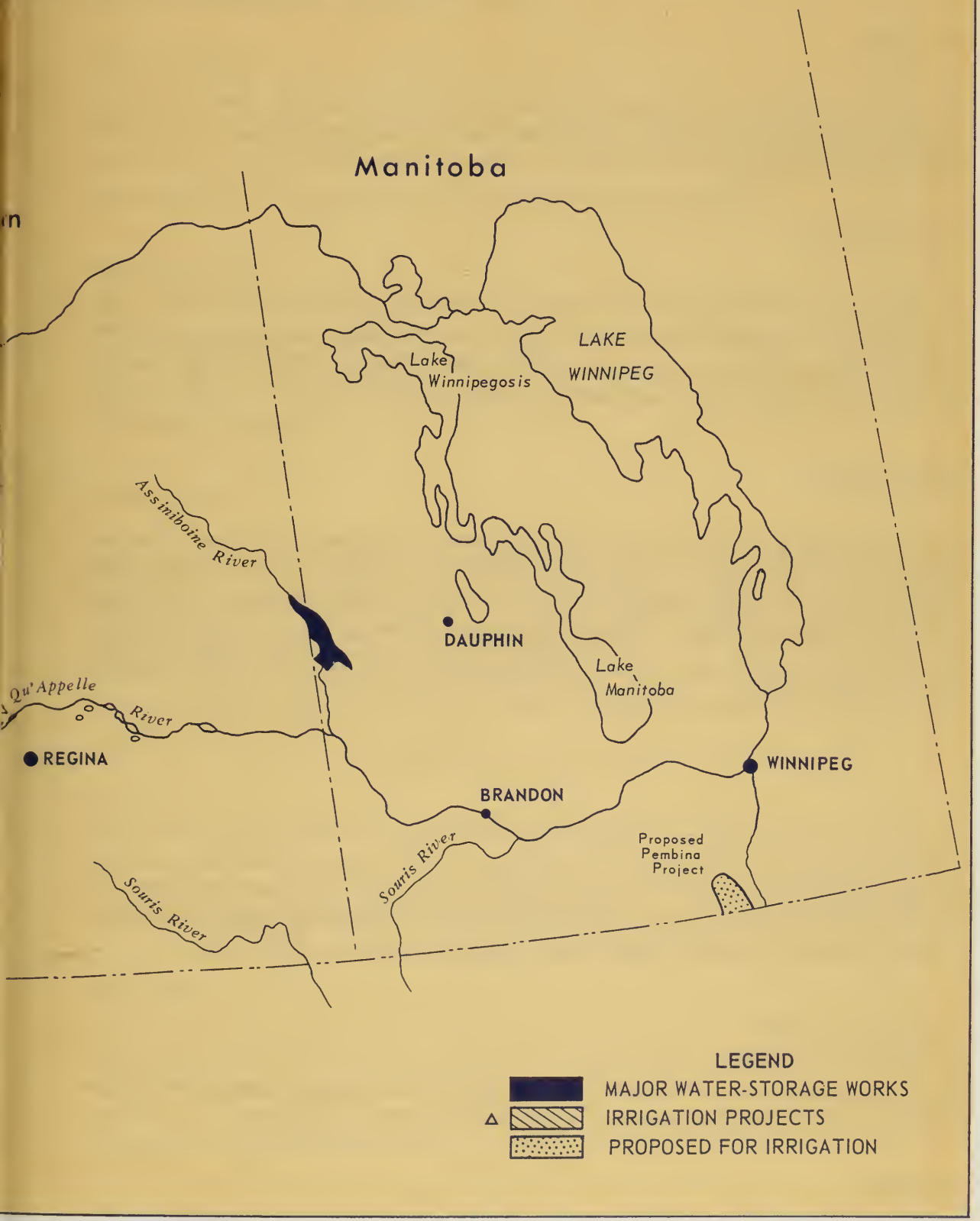
St. Mary River

'HE CANADIAN PRAIRIES



produced cereal grain. Peas are often grown after alfalfa in a rotation, since volunteer alfalfa is not a problem with peas. Work the land well and level it to promote even germination and uniform maturing of the crop.

SEEDING

Treat the seed with a recommended fungicide before planting. Sow 2 1/2 to 4 bushels of seed per acre. Drill 1 1/2 inches deep into warm, moist soil. Do not drill deeper than 3 inches.

FERTILIZING

Fertilizers may damage germinating peas and therefore should not touch them. Drill the fertilizer or broadcast and work it into the seedbed before seeding. Peas respond best to phosphorus, but some fields also need nitrogen. Obtain a soil test to determine the right kind and amount of fertilizer to use.

IRRIGATION

Peas need plenty of water from the time they are planted until shortly before harvest. Uniform irrigation is essential to ensure high-quality peas. At seeding time make sure that the land is moist enough for the seed to germinate and for the plants to grow 6 to 8 inches high. Irrigate processing peas at this stage and again shortly before harvesting the crop. Irrigate field peas when the plants are 8 inches high and later if needed. Irrigation of field peas late in the season can delay maturity.

BEANS

Good-quality bush beans for canning and freezing and field beans are grown in Alberta. Beans are important in crop rotations. In tests at the Research Station, Lethbridge, crop yields were higher after beans than after any other crop.

CHOICE OF LAND

Well-drained land with a uniform slope is best for growing beans. Beans do not grow well on poorly drained soil and they have very little tolerance for salt.

SEEDING

Prepare a firm, moist seedbed and level it to promote uniform germination. Sow beans in warm, moist soil around mid-May. Plant them about 1 inch deep in heavy

soils and as deep as 2 inches in the lighter ones. Sow 40 to 70 pounds of seed per acre, using the lower rate for smaller seeds. For machine harvesting, row spacing is 36 inches. Treat the seed with fungicide. Do not grow beans on the same land 2 years in succession.

FERTILIZING

Fertilizers reduce germination if they touch bean seeds. Band the fertilizer 2 inches to the side and slightly below the seed, or broadcast and work in all the fertilizer before planting. For accurate recommendations obtain a soil test.

CULTIVATION

When the plants are small, harrow along the rows. After the plants are above the ground, cultivate close to the rows and hill the soil to cover small weeds. Beans are shallow-rooted, so deep cultivation will damage the roots. Avoid cultivation after the blossoms appear.

IRRIGATION

Beans need enough moisture to maintain vigorous growth. Irrigate lightly because the crop is shallow-rooted, but do not leave the crop without enough water; otherwise, yield and quality will be lowered. A heavy application of water late in the season may delay the maturity of field beans.

CEREAL GRAINS

All of the cereals common in Canada may be grown on irrigated land. Usually it is not very profitable to grow hard red spring wheats. Soft spring wheat for pastry flour is grown on a large scale, and some grain is grown for registered seed. Barley is the most common cereal grown for feed. Some malting barley is also grown.

SEEDING

Cereal crops need less land preparation than other small-seeded crops. They can be grown anywhere in a rotation. Sow at slightly higher rates on irrigated land than on dry land. The year that you grow a cereal is a good time in your rotation to treat the seed for control of wireworms.

IRRIGATION

In most years, cereal crops grown on land that was irrigated the previous fall need

one good irrigation after tillering. It is important to maintain the soil water in the upper half of the available range. The number of irrigations needed depends on soil type and rainfall. Oats, wheat, and barley often lodge if irrigated after the grain is in head. To minimize or prevent lodging apply the water quickly, using a large head on short runs. Maintaining a high soil-moisture content well into the end of the growing season favors good quality in malting barley and in soft spring wheat.

FERTILIZING

Cereal crops, like grasses, respond best to nitrogen fertilizer, but they also need some phosphorus. The fertilizer formulations that have proved most suitable in southern Alberta are 27-14-0 and 23-23-0. Obtain a soil test for accurate recommendations. When large quantities of nitrogen are needed, the fertilizer may be broadcast and worked into the soil before seeding. Cereal crops respond well to residual fertility. If you have fertilized your other irrigated crops well, it is often possible to obtain a good yield of grain for 1 year without additional fertilizer.

OTHER SPECIALTY CROPS

Small acreages of vegetables and fruits for processing or for selling as fresh produce are grown under irrigation. These include carrots, red beets, cucumbers, cabbages, cauliflowers, onions, pumpkins, muskmelons, asparagus, turnips, tomatoes, sunflowers, raspberries, and strawberries. As the markets for these crops increase and, in some cases, as better varieties become available, the acreages of some of these specialty crops will increase.

FORAGE CROPS

About one-third of the irrigated land in Western Canada is seeded to crops for hay, pasture, or silage. Alfalfa and alfalfa–grass mixtures occupy the largest part of this area. Some of the forage is sold for cash, but most of it is marketed through farm livestock. The number of livestock that can be marketed from a given acreage depends on the yield and quality of the forage. The average yield of forage on irrigated land can be doubled if the land is used to its full potential, and at the same time the quality of the forage can be improved. Consequently, livestock production can be more than doubled with no increase in acreage. This can be done by using the right species and varieties of forage, fertilizing and irrigating for high yields, and harvesting at the proper time.

SEEDING

Most forage crops should be seeded 1/2 to 1 inch deep into a firm, clean seedbed. Well-packed cultivated land or clean grain stubble is satisfactory. A preseeding irrigation may be needed to provide surface moisture for germination and establishment. Early May is usually the best time to seed, but any time from early spring to mid-June or, alternatively, during August is satisfactory. Seed sweet clover in the spring only.

You can seed most grasses and grass–legume mixtures through the seed box of a grain drill. Set the drill to seed 1 bushel of wheat, and adjust it, if necessary, after one or two rounds of the field. Start with only a small amount of seed in the box so that it will be easy to estimate the amount used. Never fill the box more than one-third full. For alfalfa and very small-seeded grasses use a grass-seeding attachment on the drill or broadcast the seed, then harrow, and pack. A press drill is preferable because it packs the soil well. Packing is very important. To improve soil moisture conditions for the seed and to prevent seeding too deep, pack before seeding on worked land.

COMPANION CROPS

Companion crops of grain compete with the forage seedlings, but sometimes they are useful for holding the soil against the wind. They may also suppress weeds. If you use a companion crop, seed it at half the normal rate and irrigate to keep the surface soil moist. Seed the companion crop first, then the forage crop crosswise to it. Do not be discouraged if the forage crop appears poor at the end of the first season. It will not develop into a vigorous stand until June of the following year.

WEED CONTROL

It is best to seed only into clean land, but, even so, weeds will appear. If chemical weed control seems justified, begin early when seeded grasses have three or more leaves and legumes have two or three trifoliate leaves. Consult an up-to-date weed control bulletin for information on chemicals and rates, for example, *Chemical Weed Control in Forage Crops, Seeded Hay and Pasture,* Alberta Department of Agriculture Bulletin 641/128, 1968. If weeds persist in a new seeding, mow in the late summer and conserve the weeds and forage as hay or silage. Mowing often controls weeds in established stands, but herbicides may also be needed.

CROPS AND VARIETIES

Some crops are best suited for hay and others for pasture. Be prepared to use them for either purpose as required. In spring, any surplus of pasture can be harvested for

hay or silage. In fall, the hay crops that do not grow tall enough to be cut can be grazed. Harvest all the forage you grow.

Always use the best variety available. Seed of new varieties often costs more than ordinary seed, but it is usually well worth the extra cost.

HAY

Alfalfa

Alfalfa is the most important hay plant. It is grown either alone or in mixture with grasses on nearly 3 million acres in Western Canada. It is deep-rooted and grows best on well-drained soil. Yields of over 5 tons of hay per acre are possible, though the average is much less. Use one of the recommended varieties, because they live longer and are more winter-hardy and disease-resistant than the older varieties. Data from the Research Station, Lethbridge, show how the recommended variety Beaver outproduced the older variety Grimm.

Yields, in tons of dry matter per acre, of two alfalfa varieties in 5 successive years at Lethbridge, 1961 – 65

	1961	1962	1963	1964	1965	Total
Beaver	4.35	4.62	5.26	4.56	3.00	21.79
Grimm	4.11	4.40	4.89	2.61	1.33	17.34

During the 5 years, Beaver produced almost 5 tons more hay per acre than Grimm. The small extra cost for seed of the better variety was returned many times over. Unless you intend to sell alfalfa hay, it is usually better to grow alfalfa with a grass. The mixture cures faster and yields more in later years if the alfalfa starts to die out. Mixtures are also safer than alfalfa alone for pasturing, because of the danger of bloat. Bromegrass is commonly grown with alfalfa, but intermediate wheatgrass, pubescent wheatgrass, or, in some cases, reed canarygrass may be used.

Fertilize alfalfa with 50 pounds of P_2O_5 per acre per year. No nitrogen fertilizer is needed.

Apply 4 or 5 inches of water three times during the growing season and once in the fall before freeze-up. Plan the irrigations so that they will not interfere with the hay harvest: usually one irrigation during early June and two during the summer, after the first harvest.

To obtain the highest yield of protein, cut alfalfa when about one-tenth of the plants have open flowers. Most grasses should be cut when they begin to flower, though timothy should be cut at the time of heading. Normally you can expect two hay cuts in a year. The second cutting of alfalfa should be no later than 3 weeks before the first fall frost. Do not cut during September. In some years you can make a third cutting in mid-October, though grazing will often be a better way to harvest this aftermath.

Grass

Grass is grown alone for hay only in special circumstances. On wet lands reed canarygrass may be the only suitable species, or, on saline land, tall wheatgrass. For high yields grass hay on irrigated land needs 100 pounds or more of nitrogen fertilizer and 25 to 50 pounds of P_2O_5 annually. Mixtures that are predominantly alfalfa can be managed in the same way as alfalfa alone.

PASTURE

Irrigated pasture means much more than simply grassland to which water is applied. Irrigated pasture should be regarded as a crop that must be grown and harvested efficiently. It requires as much skill in managing as any other crop and can be one of the most profitable. It can be a part of the rotation or it can be more permanent. Short-term pastures can be used for 1 to 4 years, whereas long-term pastures may produce well for 10 years or more.

Grasses

No one grass can be recommended for irrigated pasture throughout Western Canada. Local conditions often are more favorable for one species than for others. Consult your agricultural extension representative for detailed recommendations.

Bromegrass is a widely adapted dual-purpose grass that is capable of producing high yields. It is not an ideal pasture grass because it is easily damaged by close grazing.

Creeping red fescue is widely adapted and withstands heavy use. It does not appear to be well liked by livestock, but they graze it when no other choice is offered. It remains green well into the fall.

Intermediate wheatgrass is similar to pubescent wheatgrass, though it is possibly slightly lower yielding on irrigated land.

Kentucky bluegrass is less popular now than it once was, but it is a useful pasture grass where management is not intensive and where winters are severe.

Orchardgrass makes quick regrowth after grazing and withstands heavy use. It is an excellent pasture grass in many ways, but it is not as nutritious as pubescent wheatgrass. The variety Chinook is hardy near Lethbridge, though it may winter-kill outside that area.

Pubescent wheatgrass appears to be a very nutritious feed for cattle. It begins growth early in spring and gives high yields. It produces little during the first 3 weeks of July and then grows well again in late summer. It is widely adapted.

Reed canarygrass grows well on wet soils. It is useful near canals and ditches, where other grasses grow poorly. It is not highly nutritious when offered as a sole feed.

Timothy is seldom grown alone for pasture. It can be used in a mixture or for dual-purpose hay and pasture. Production in late summer may be poor, except in the latest improved varieties.

Legumes

Legumes are often seeded with grasses for pasture because they increase the protein content of the feed and add nitrogen to the soil. If heavy applications of nitrogenous fertilizers are used, the legume may soon be crowded out, but it is still worth including in the mixture. Bloat is a hazard to cattle and sheep when grazing most legumes. To avoid the risk completely, do not seed alfalfa or clover in your pastures, and apply extra nitrogen to get equal production.

Ladino clover is the most useful of the pasture legumes, provided that a hardy variety is used. It is a type of white clover. Close, frequent grazing encourages growth, whereas using the pasture as a hayfield may eliminate it. The danger of bloat in cattle and sheep is in proportion to the amount of clover in the mixture, which should never be more than half of the total forage.

Alfalfa may be used in irrigated pasture, especially for dual-purpose mixtures. It will not tolerate close, frequent grazing. The danger of bloat is greater with alfalfa than with Ladino clover.

Alsike clover is widely adapted, but is used mostly for wetland pasture.

Birdsfoot trefoil has not been widely used in Western Canada because winter-hardy varieties have not been readily available. It is not known to cause bloat. It is best when seeded alone.

Mixtures

Many different mixtures can be made with various combinations of these species and a few are suitable for Western Canada. Some basix mixtures, with recommended varieties in parentheses, are:

Mixture 1

Bromegrass (Carlton)	8 pounds per acre
Orchardgrass (Chinook)	5
Creeping red fescue (Boreal)	5
Ladino clover (Merit)	2
Total	20

This mixture has been successful near Lethbridge, where orchardgrass is winter-hardy. It can be grazed from mid-May to mid-September if it is well fertilized and irrigated often. It should be very productive for 6 to 10 years.

Mixture 2

Pubescent wheatgrass (Greenleaf) or Intermediate wheatgrass (Chief)	15 pounds per acre
Ladino clover (Merit)	2
Total	17

This mixture can be very productive for 3 or 4 years, but you must provide alternative grazing during the first 3 weeks of July. At Lethbridge, pubescent wheatgrass pasture has produced high daily gains on yearling steers.

Mixture 3

Kentucky bluegrass (Troy)	6 pounds per acre
Bromegrass (Carlton)	8
Ladino clover (Merit)	2
Total	16

This is not the best mixture for the most suitable sites, but it will be reasonably productive for many years. It survives severe winters and casual management.

Mixture 4

Bromegrass (Carlton)	12 pounds per acre
Alfalfa (Roamer)	2
Total	14

This is a good dual-purpose mixture. It can be grazed for a week or two in May, cut for hay in late June, and then either pastured or cut for hay again.

Mixture 5

Reed canarygrass (Frontier)	4 pounds per acre
Timothy (Champ)	4
Alsike clover (Aurora)	2
Total	10

This mixture can be used on wet land where salinity is not severe.

For annual pasture, seed annual ryegrass at 20 pounds per acre, oats at 3 bushels per acre, or sorghum – Sudangrass hybrids at the recommended rates. Do not graze sorghum – Sudangrass hybrids before they are 18 inches tall or when growth is slow, because of the danger of prussic acid poisoning.

Management

Use rotational grazing by dividing the pasture into several fields, which can be grazed in turn. In this way the animals are removed from the field during irrigation and they are provided with young, highly digestible grass. You should have at least four fields, and it is an advantage to have more. Use electric fences where convenient. More than half the grass will be produced by the end of June. Cut some of this grass for hay or silage. A pasture that carries five steers per acre in June will only carry one in late August.

Do not waste grass but do not try to force the animals to clean it all up. When grass is short, cattle will eat less and daily gains or milk production will fall. Graze each rotation field for 4 or 5 days and then move the animals to fresh grass. The grazed field will take 15 to 18 days to recover in mid-June and 6 weeks in August – September.

Mow coarse grass and weeds after the pasture has been grazed, then fertilize and irrigate if necessary. Apply 2 to 3 inches of water at each irrigation. You may have to irrigate each field six times during the season. Do not let the top 6 inches dry out because that is where almost 90 percent of the grass roots are.

For top yields, fertilize with 40 to 50 pounds of nitrogen per acre four times each year, in April, June, July, and August. If phosphorus is needed, apply 50 pounds of P_2O_5 per acre each spring. If you do not need top yields and your pasture contains about 40 percent clover, you may manage with one application of nitrogen in April. Heavy nitrogen fertilization will eliminate the clover after the first year or two. Grasses will usually grow well if water and nitrogen are supplied.

SILAGE

The biggest advantages of silage are that it can be stored quickly, and weather is not so limiting as it is in hay making. Silage also allows you a wider choice of crops. Usually more labor is needed to feed silage than to feed hay.

Pit, bunker, and tower silos are used in Western Canada. Pits and bunkers are the cheapest to construct, though labor for feeding out the silage may be high. Feeding from tower silos can be easily automated. The cheapest silo to construct is not always the most economical. Up to half of the feed stored in a poor silo may be lost through spoilage.

Any green crop can be used to make silage provided that it has enough moisture to permit proper fermentation. Crop by-products as well as main crops can be safely stored.

Green oats are the most popular crop for silage in Western Canada. Use a late variety and cut when the grain is in the late milk stage. Yields of silage usually range from 8 to 12 tons per acre.

Alfalfa silage often has a foul smell. However, the smell can be avoided by leaving the alfalfa for a few hours after cutting until the moisture content falls to 65 percent. Cut it short and pack it well.

Grass from the irrigated pasture surplus in spring should be wilted before ensiling, and then throughly packed.

Corn is the highest-yielding crop where it is adapted. Use a hybrid that has been recommended for your area. Ensile when the grain is dented. Space the plants as uniformly as possible, with about 20,000 plants per acre. Plan the row spacings to fit your harvester. You will need about 15 pounds of seed per acre. Good crops will yield 15 to 20 tons of silage per acre.

Sorghum – Sudangrass hybrids can be grown in and beyond the corn area. Plant them in early June, and harvest the silage in August or September. They will yield almost as much as corn, but the feeding value may be lower.

Crop by-products such as sugar beet tops and pea vines should be wilted before ensiling. You can expect yields of 4 to 7 tons of silage per acre.

Hailed cereal crops should be ensiled before they get too dry. They sometimes contain toxic levels of nitrate, but they can safely be used for feed after a period of storage. It is wise to have the silage analyzed before feeding it to your cattle.

OTHER SPECIAL CROPS

Corn can be grown for grain in southern Manitoba and on the lighter soils of southeastern Alberta. Early hybrids must be used, and, even then, some years there is a risk of frost before the grain is mature. Consult your local extension personnel for recommendations. Seed production of some grasses and legumes is warranted on irrigated land. Current market prices determine whether or not it is economically sound. Alfalfa seed production, with domesticated alfalfa leaf-cutter bees as pollinators, has been a successful venture for some farmers in southern Alberta.

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